Calculation of Percentage of Cases on File with an Unnamed Father in 100 One-Man and 100 Two-Man Cases (Filiation Cases) from South-West Germany in 1976—1981

Ratio of Defendants to Witnesses Among Non-excluded Men in Two-Man Cases

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Summary. Applying the formula of Schulte-Mönting and Hummel to 100 one-man affairs (filiation cases) in South-West Germany between 1979 and 1981 gave a realistic prior probability of paternity of 0.837 ± 0.0372. This means that in approximately 83.7% of all one-man affairs the man named by the mother to be the father of her child is indeed the father.

For two-man affairs a realistic prior probability of paternity of 0.863 ± 0.0369 was calculated on the basis of 100 two-man affairs in South-West Germany between 1976 and 1981. In other words, there is a probability of about 86.3% that a non-excludable man—irrespective of other factors—in a two-man affair is the real father of the child. In approximately 13.7% of two-man affairs neither the "defendant" nor the witness is the father, but a third unknown person. In about 85.7% of the two-man affairs in which a father of the child was named the "defendant" is in fact the father and in 14.3% the "witness" is the father.

Key words: Probability of paternity – Prior probability – Blood group expertise

Zusammenfassung. Anhand von 100 Einmannsachen (Kindschaftsfälle) der Jahre 1979–1981 aus Südwestdeutschland errechnete sich nach dem Ansatz von Schulte-Mönting und Hummel eine realistische A-priori-Vaterschafts-wahrscheinlichkeit von $0,837 \pm 0,0372$. Dies bedeutet, daß in rund 83,7% aller Einmannsachen der von der Kindesmutter als Erzeuger benannte Mann der tatsächliche Vater des Kindes ist.

Aus 100 Zweimannsachen der Jahre 1976–1981 errechnete sich eine realistische A-priori-Wahrscheinlichkeit von $0,863 \pm 0,0369$. Diese besagt,

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daß ein in einer Zweimannsache von der Vaterschaft nicht ausschließbarer Mann — ohne Berücksichtigung sonstiger Umstände — mit einer Wahrscheinlichkeit von rund 86,3% der wahre Vater des Kindes ist; bei rund 13,7% der Zweimannsachen ist weder der Beklagte noch der Zeuge, sondern ein dritter unbekannter Mann der tatsächliche Vater des Kindes. Durch Auszählen fand sich, daß in Zweimannsachen mit benanntem Vater rund 85,7% der wahren Väter „Beklagte" sind, 14,3% „Zeugen".

Schlüsselwörter: Vaterschaftswahrscheinlichkeit – A-priori-Wahrscheinlichkeit – Blutgruppengutachten

Introduction

In practice the most important realistic prior probability in the biostatistical evaluation of blood group findings in cases of disputed paternity is the percentage of "Akten a priori" (prior probability in cases on file) in which the real father of the child is or is not named (= father a priori). The size of this a priori in one-man cases (i.e., cases in which one man is named in the files as presumed father of the child) can be taken as a measure of the tendency of mothers to remain silent about cohabitants. In two-man affairs (i.e., those in which two men are named in the files as possible father of the child, the percentage of non-father cases is a measure of the tendency of mothers to conceal third (and further) cohabitants.

A probability of paternity W, calculated according to the principle of Essen-Möller—and applicable in one-man cases[1]—uses a neutral prior probability of 0.5. Moreover, the expert can, by using a realistic prior probability, provide a probability of error calculated as follows:

$$W_i = \cfrac{1}{1 + \left[\cfrac{W_{apr}}{1 - W_{apr}} \cdot \cfrac{W}{1 - W} \right]},$$

where W_i is the probability of error;
    W the probability of paternity according to Essen-Möller; and
    W_{apr} the prior probability of paternity.

Up to the late 1960s it was accepted in German legal practice that in one-man affairs (filiation cases) approximately 50% of the men named by the mothers of the children involved as father of the child were the real fathers. In other words, the neutral prior probability of 0.5 in the Essen-Möller formula was practically identical with the real value. In two- and three-man cases, on the other hand, a higher prior probability was already current, i.e., 0.829 and 0.847, respectively [1]. Thus, the W-value calculated by Essen-Möller's formula for a non-excluded man in a two- or three-man affair provided in reality a far more concrete probability of paternity than the value expresses.

By the mid-1970s the realistic prior probability in one-man affairs had already risen to 0.65–0.78 [2, 3]. In contrast, that for two-man cases was more or less

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1 That is, in the blood group opinion one man cannot be excluded from paternity

unchanged. Half a decade later one must assume a further rise in the prior probability, particularly that for one-man cases. To test this surmise we evaluated cases on file from recent years.

Apart from the a priori mentioned for one- and two-man affairs there is also a "defendant-witness-a-priori" for multiple-man cases involving two and more non-excludable men, including the defendant. This may be explained as follows: a non-excludable man in a multiple-man affair is called in the files either the „defendant" or the "cohabiting witness" (in short the "witness").

Now, it is an established fact that the mothers in multiple-man affairs tend to name the real father as father of the child more frequently than a non-father. Accordingly, the prior probability for a non-excluded "defendant" is greater than for a similarly non-excluded "witness". The latest figures for this a priori—0.7 for the "defendant" and 0.3 for the "witness"—are based on "Aktenfälle" (cases on file) of the 1960s [1]. It was thus time to determine a new value for this a priori. This can be done easily by counting the non-excluded defendants and witnesses in one-man cases from two-man affairs.

Material and Methods

One hundred one-man (1979–1981) and 100 two-man affairs (1976–1981), involving only filiation cases and not legitimacy disputes, were randomly selected from current material. The blood group findings were fed into the computer, which printed out the following information and results in accordance with the programs used:
1. Typed gene systems and characteristics for individual cases;
2. their summarized frequencies.
3. The number of men excluded and the respective systems or characteristics in which they excluded.
4. The total number of excluded men.
5. The mean exclusion chance on the basis of the mother-child constellations involved.
6. The frequency of fathers and non-fathers, respectively.

Schulte-Mönting and Hummel's method [4] was applied to obtain the frequencies of fathers and non-fathers. To arrive at the final value 5–7 iteration steps, using the Newton formula, had to be carried out (correction term: $3.5018 \cdot 10^{-8}$ and $2.6548 \cdot 10^{-7}$).

The evaluation took into account findings in 32 gene systems. At least $\frac{1}{3}$ and at the most $\frac{2}{3}$ of them were involved in one- and two-man affairs.

The blood group opinion excluded 16 of the 100 men in the 100 one-man affairs and 108 of the 200 men in the 100 two-man affairs. After exclusion one non-excludable man remained in 84 two-man affairs, two men remained in four, and in 12 both men were excluded.

Results

A mean exclusion efficiency for non-fathers was calculated as $A' = 98.42\%$ from the 100 mother-child constellations of the one-man affairs, and one of $A'' = 93.87\%$ from those of the two-man affairs. The higher exclusion efficiency in one-man affairs may well be explained by the fact that these data date from the years 1979–1981, whereas some of the data for the two-man affairs go back to 1976, i.e., to years when the number of systems investigated was lower.

The expected percentage of files without a named father in one-man affairs was calculated to be 16.26%, for two-man affairs 13.67%. The prior probability of paternity (= percentage of cases with a named father) in one-man affairs is thus 83.74%, in two-man affairs 86.33%. To take into account the realistic father a priori in a serostatistical evaluation to filiation cases, EM = 9.2882 must be added to the EM-value of a man in one-man affair, and EM = 9.1996 in a two-man affair.

Of the 84 non-excluded men in one-man cases deriving from two-man affairs 72 were "defendants" and 12 "witnesses". Hence, the "prior probability" for defendants in two-man cases can be taken as 0.8571 (= 85.7%), and for witnesses as 0.1429 (= 14.29%).

Discussion

Realistic Prior Probability of Paternity in One- and Two-Man Affairs

The higher prior probability values for fathers and non-fathers shows that nowadays mothers of illegitimate children are evidently (1) far less afraid to name cohabitants immediately, and (2) more frequently prepared to name all men who may possibly have fathered the child, than they were in the past. The narrowing of the gap between the a priori values in one-man and two-man affairs means that nowadays the naming of a non-father as father of the child is evidently more or less independent of the fact whether all cohabitants are named or not. Standard deviations (SD) are 0.0372 and 0.0369. They do not weaken the assumption that the realistic prior probability for a non-excludable man in a one- or two-man affair is nowadays at least 0.8 (= 80%).

There are basically two explanations for the increased readiness of mothers to admit to cohabitation with different men.

1. As mothers have become more aware of the efficiency of blood group opinions they have made a greater effort to speak the truth, i.e., (a) to name all cohabitants and (b) not to name a "desired father" as the father of the child but the man they feel to be the father.

2. In recent years mothers have been adopting an increasingly liberal attitude to moral judgements on their private life.

Most assessments give greater weight to the first explanation. However, there are some objections to this. On the one hand, one cannot establish any parallel behavior between the actual one-man a priori and the mean exclusion efficiency of blood group opinions in different countries or in different populations [3]. On the other hand, it is easy to prove that mothers usually know very little or nothing about the efficiency of blood group opinions when officially requested for the first time to name the father of their illegitimate child. Quite the opposite: mothers (though less so putative fathers) are often sceptical about the usefulness of expertise on biologic parentage. Hence, the second explanation seems to carry more weight (see [3]).

If, even before a blood group opinion was sought, mothers mention all cohabitants (if, indeed, there was cohabitation at the time of conception), and if all cohabitants were always named in the blood group opinion, the prior probability

of paternity for a non-excludable man in both one- and multiple-man affairs would always be 1, i.e., he could with certainty be named as the father of the child. In reality, this ideal situation is unattainable, but one can come very close to it. In Denmark, for instance, there is a prior probability of approximately 90% [3]. In Southern Europe, on the other hand, one has to be satisfied with lower values [3], perhaps even as low as 0.5, i.e., a value close to what was current in the Federal Republic of Germany 15 years ago.

If one regarded the prior probability purely as a "lie factor" [5, 6], and, thus, accused the mothers of concealing cohabitants for the sole purpose of acquiring a suitable father for the child, the mendacity of mothers would increase strongly from North to South—up to a fivefold difference between the extremes. However, such an assumption is not realistic. A more credible explanation for the geographic differences in the prior probabilities is that moving from North to South mothers are more afraid to mention all cohabitants.

Throughout Europe the prior probability of paternity for non-excludable men has risen over the past years and decades. From this it may be concluded (with caution) that the moral condemnation of poly-cohabitation on the part of un-married women is weakening, even in regions where the population is still very religious. As sexual morality becomes less strict another moral category must benefit which is the desire for truth.

The "Defendant a Priori"

At the end of the 1960s the percentage of fathers among "defendants' was 70%, among "witnesses" 30% [1]. As we have seen above, these figures are now 85.7% and 14.3%. The 'accuracy' of mothers in choosing the father of the child from among at least two cohabitants has greatly improved over the past decade.

It is difficult to establish the reasons why the man named as father (= "defend-ant") by the child's mother in a two-man affair should more frequently be the real father than was previously the case. Perhaps mothers have learnt of the progress made in serologic paternity expertise in the last two decades (since establishing the first "d/w" ratio), with the result that they are less inclined to name a "desired father" (instead of the real father) as the father of their child. If this assumption is indeed true, this would mean that the "lie factor" in the "d/w" ratio had become less important over the last 20 years.

In this case one would also have to assume a specific "lie factor" for the one-man a priori. However, it is far more likely that the significant increase in the prior probability in one-man affairs from approximately 0.75 to approximately 0.84 within the space of only 5–6 years may be ascribed to reduced silence rather than reduced mendacity (cf. above).

A case in which the "witness" was named not by the child's mother but by someone else, e.g., the defendant, would thus not qualify for a "defendant a priori" for the child's mother would not have made the initial choice between concrete men. Equally unsuitable for the use of this a priori would be a case in which the mother declined to name any of the men in question as father of the child.

A defendant a priori can be used only if a "defendant" and—for purposes of comparison—one or more "witnesses" are possible fathers of the child plaintiff. It cannot be applied if the defendant or the witness(es) are excluded from paternity[2].

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2 Only the man named as likely father in the first opinion can be called the "defendant" (= "initial defendant")

Table 1

		Father's a priori for multiple man cases	Defendant's a priori	Both types of a priori
Defendant (not excluded)	⎫		0.8571	0.7399
Witness (not excluded)	⎬ 0.8633		0.1429	0.1234
Fictitious cohabitant		0.1369	—	0.1367
		1.0000	1.0000	1.0000

The reason for this is that if the defendant is excluded his probability of paternity becomes null; the "defendant a priori" would become null as well, and, hence, meaningless. If the witness or the witnesses are excluded from paternity his (their) probability of paternity becomes null, and, correspondingly, his (their) "witness a priori" as well.

Table 1 shows the a priori situation in a two-man case, using the new a priori values given in this paper.

For each of the three hypotheses in a two-man case (1. the defendant is the father; 2. the witness is the father; 3. an unknown cohabitant is the father) there is a realistic a priori:

$$
\left.
\begin{aligned}
p_{\mathrm{D}} &= 0.7399 \\
p_{\mathrm{W}} &= 0.1234 \\
p_0 &= \underline{0.1367}
\end{aligned}
\right\} \quad 0.8633
$$
$$
1.0000
$$

With the following formula these three a priori values can be inserted into the W values (W_1; W_2; W_0, where $W_1 + W_2 + W_0 = 1$).

$$
W' = \frac{p \cdot W}{[p \cdot W] + [(1-p) \cdot (1-W)]},
$$

where W' is the realistic concreteness of the respective hypothesis $(W_D''$; W_W'' ; $W'_0)$, p the realistic prior probability of paternity for the respective hypothesis $(p_D;$ $p_W; p_0$, where $p_D + p_W + p_0 = 1$) and W the normed probability of paternity according to Schulte-Mönting and Hummel $(W_D; W_W; W_0)$ [4].

In this material only four of the 100 two-man affairs did not have an exclusion and are hence suitable—as two-man cases—for the application of a defendant-witness a priori.

Cases in Which More than Two Men are Named in the Files

Our material included a few cases in which more than two men were named. However, they were too few in number to establish a father a priori as well as a defendant-witness a priori. In a previous evaluation [1] the difference between the values for two- and three-man affairs was negligible ($p_{\mathrm{real}} = 0.829$ and $p_{\mathrm{real}} = 0.847$,

Table 2

	Father's a priori	Defendant's a priori	Both kinds of a priori
Defendant (not excluded) ⎫		0.8571	0.7399[a]
Witness 1 (not excluded) ⎬	0.8633	—	0.0617[a]
Witness 2 (not excluded) ⎭		0.1429	0.0617[a]
Fictitious cohabitant	0.1367	—	0.1367
	1.0000	1.0000	1.0000

[a] $0.7399 = 0.8571 \cdot 0.8633$; $0.0617 = (0.1429/2) \cdot 0.8633$

respectively). One may assume that nowadays the differences would also be negligible (particularly in view of the fact that the prior probabilities in one- and two-man affairs are virtually the same). Accordingly, one will apply the value for two-man affairs (0.8633) to three- and four-man affairs as well.

The question of the probability to be applied in cases involving five or more men, i.e., cases "abnormal" by their very nature, must remain unanswered. The "neutral" prior probability may be most suitable.

As we have seen above, a "defendant-witness a priori" can be applied (1) when in two-man affairs neither man is excluded, (2) when three-, four-, and multiple-man affairs have been reduced to two-man cases, as long as the "defendant" is still involved, and (3) in cases involving more than two non-excludable men, as long as the "defendant" is among them.

It would be desirable to establish and use separate defendant a prioris for two-, three-, four-, and multiple-man affairs on the basis of suitable expertise. In the present paper we have restricted ourselves to establishing a prior probability in two-man affairs. There was not enough material on file involving more than two men. On the other hand, there is no reason to suspect that the defendant's a priori in cases involving three or more men differs much from that for two-man affairs— or is likely to (cf. the values of the father's a priori in one- and multiple-man affairs above). Hence, until such values are established the expert can apply the defendant's a priori of 0.8571 determined here also in cases where more than two men are named.

If more than two men, including the defendant, cannot be excluded in the blood group opinion from paternity of the child, then the prior probability for the defendant will be 0.8571 and for the other non-excludable men 0.1459 (= "witnesses"). Accordingly, the situation in a three-man case is as shown in Table 2.

The W-value obtained from the Schulte-Mönting and Hummel formula is combined with the respective prior probabilities using the formula given above.

As can be seen, the "witness a priori" of 0.1429 is divided equally between each of the non-excludable cohabitant witnesses. And, indeed, there is no reason to suppose that one witness carries greater weight than the other[3]. Therefore, they must be treated a priori as equals.

3 For instance, a child's mother is not asked who, besides the defendant, of the named co-habitants is the likely father of the child

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